WHAT IS CLAIMED IS:

1. A porous substrate for epitaxial growth, comprising:

an underlying layer made of III-nitride semiconductor;

a void-formation preventive layer grown on the underlying layer;

a porous III-nitride semiconductor layer; and

a porous metallic layer grown on the porous III-nitride semiconductor layer.

2. The porous substrate for epitaxial growth as defined in claim 1, wherein:

the underlying layer made of III-nitride semiconductor is a GaN free-standing substrate.

3. The porous substrate for epitaxial growth as defined in claim 1, wherein:

the underlying layer made of III-nitride semiconductor is grown on a base material.

4. The porous substrate for epitaxial growth as defined in claim 1, wherein:

a thickness of the underlying layer made of III-nitride semiconductor is 300 nm or more.

5. The porous substrate for epitaxial growth as defined in claim 3, wherein:

the base material is prepared from at least one material selected from the group consisting of sapphire, silicon, silicon carbide, langasite, zirconium diboride, and gallium arsenide.

6. The porous substrate for epitaxial growth as defined in claim 1, wherein:

the III-nitride semiconductor is prepared from at least one material selected from the group consisting of GaN, AlGaN, InGaN, and InAlGaN.

7. The porous substrate for epitaxial growth as defined in claim 1, wherein:

the void-formation preventive layer has less than 6% lattice constant difference with respect to that of the underlying layer.

8. The porous substrate for epitaxial growth as defined in claim 7, wherein:

the void-formation preventive layer is prepared from AlGaN.

9. The porous substrate for epitaxial growth as defined in claim 1, wherein:

the void-formation preventive layer is a superlattice structure composed of alternately grown plural pairs of an $Al_xGa_{1-x}N$ ($0 < x \leqq 0.5$) layer and an $Al_yGa_{1-y}N$ ($0 \leqq y < x$) layer.

10. The porous substrate for epitaxial growth as defined in claim 1, wherein:

a thickness of the void-formation preventive layer is 3 nm or more.

11. The porous substrate for epitaxial growth as defined in claim 1, wherein:

a thickness of the porous III-nitride semiconductor layer is 3 μm or less.

12. The porous substrate for epitaxial growth as defined in claim 1, wherein:

the porous metallic layer is prepared from at least one material selected from the group consisting of titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, yttrium, zirconium, niobium, molybdenum, tellurium, ruthenium, rhodium, palladium, hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, and gold, or the nitrides thereof.

13. A porous substrate for epitaxial growth, comprising:

a sapphire substrate;

a GaN layer grown on the sapphire substrate;

an AlGaN layer grown on the GaN layer;

a porous GaN layer grown on the AlGaN layer; and

a porous TiN layer.

14. A method for manufacturing a porous substrate for epitaxial growth, comprising the steps of:

growing a void-formation preventive layer on an underlying layer made of III-nitride semiconductor;

growing III-nitride semiconductor layer on the void-formation preventive layer;

growing a metallic layer on the III-nitride semiconductor layer; and

forming voids in the III-nitride semiconductor layer and the metallic layer grown on the void-formation preventive layer.

15. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 14, wherein:

the underlying layer prepared from the III-nitride semiconductor is a GaN free-standing substrate.

16. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 14, further comprising the step of:

growing the underlying layer made of the III-nitride semiconductor on a base material.

17. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 16, wherein:

the base material is prepared from at least one material selected from the group consisting of sapphire, silicon, silicon carbide, langasite, zirconium diboride, and gallium arsenide.

18. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 14, wherein:

the III-nitride semiconductor is prepared from at least one material selected from the group consisting of GaN, AlGaN, InGaN, and InAlGaN.

19. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 14, wherein:

the void-formation preventive layer is made of AlGaN or a metallic nitride having a lattice constant close to that of the underlying layer.

20. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 14, wherein:

the void-formation preventive layer is a superlattice structure composed of alternately grown plural pairs of an $Al_xGa_{1-x}N$ ($0 < x \leqq 0.5$) layer and an $Al_yGa_{1-y}N$ ($0 \leqq y < x$) layer.

21. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 14, wherein:

the metallic porous layer is made of at least one material selected from the group consisting of titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, yttrium, zirconium, niobium, molybdenum, tellurium, ruthenium, rhodium, palladium, hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, and gold, or the nitrides thereof.

22. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 14, further comprising the step of:

forming voids in the III-nitride semiconductor layer and the metallic layer grown on the void-formation preventive layer by means of the heat treatment.

23. The method for manufacturing a porous substrate for epitaxial growth as defined in claim 22, wherein:

the heat treatment is implemented in an atmosphere containing hydrogen gas or a hydride gas.

24. A method for manufacturing a porous substrate for epitaxial growth, comprising the steps of:

growing a first GaN layer on a sapphire substrate;

growing an AlGaN layer on the first GaN layer;

growing a second GaN layer on the AlGaN layer;

growing a Ti layer on the second GaN layer; and

heat-treating the second GaN layer and the Ti layer in a mixed gas atmosphere of hydrogen gas and a hydride gas to form voids in the second GaN layer and the Ti layer.

25. A method for manufacturing III-nitride semiconductor substrate, comprising the steps of:

growing a void-formation preventive layer on an underlying layer made of III-nitride semiconductor;

growing III-nitride semiconductor layer on the void-formation preventive layer;

growing a metallic layer on the III-nitride semiconductor layer;

forming voids in the III-nitride semiconductor layer and the metallic layer grown on the void-formation preventive layer;

epitaxially growing III-nitride semiconductor substrate on the metallic layer in which voids are formed; and

exfoliating the III-nitride semiconductor substrate from the metallic layer.

26. The method for manufacturing III-nitride semiconductor substrate as defined in claim 25, wherein:

the underlying layer made of the III-nitride semiconductor is a GaN free-standing substrate.

27. The method for manufacturing III-nitride semiconductor substrate as defined in claim 25, further comprising the step of:

growing the underlying layer made of the III-nitride semiconductor on a base material.

28. The method for manufacturing III-nitride semiconductor substrate as defined in claim 27, wherein:

the base material is prepared from at least one material selected from the group consisting of sapphire, silicon, silicon carbide, langasite, zirconium diboride, and gallium arsenide.

29. The method for manufacturing III-nitride semiconductor substrate as defined in claim 25, wherein:

the III-nitride semiconductor is prepared from at least one material selected from the group consisting of GaN, AlGaN, InGaN, and InAlGaN.

30. The method for manufacturing III-nitride semiconductor substrate as defined in claim 25, wherein:

the void-formation preventive layer is made of AlGaN or a metallic nitride having a lattice constant close to that of the underlying layer.

31. The method for manufacturing III-nitride

semiconductor substrate as defined in claim 25, wherein:

the void-formation preventive layer is a superlattice structure composed of alternately grown plural pairs of an $Al_xGa_{1-x}N$ ($0 < x \leqq 0.5$) layer and an $Al_yGa_{1-y}N$ ($0 \leqq y < x$) layer.

32. The method for manufacturing III-nitride semiconductor substrate as defined in claim 25, wherein:

the metallic porous layer is made of at least one material selected from the group consisting of titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, yttrium, zirconium, niobium, molybdenum, tellurium, ruthenium, rhodium, palladium, hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, and gold, or the nitrides thereof.

33. The method for manufacturing III-nitride semiconductor substrate as defined in claim 25, further comprising the step of:

forming voids in the III-nitride semiconductor layer and the metallic layer grown on the void-formation preventive layer by means of the heat treatment.

34. The method for manufacturing III-nitride semiconductor substrate as defined in claim 33, wherein:

the heat treatment is implemented in an atmosphere containing hydrogen gas or a hydride gas.

35. A method for manufacturing III-nitride semiconductor substrate, comprising the steps of:

growing a first GaN layer on a sapphire substrate;

growing an AlGaN layer on the first GaN layer;

growing a second GaN layer on the AlGaN layer;

growing a Ti layer on the second GaN layer; and

heat-treating the second GaN layer and the Ti layer in a mixed gas atmosphere of hydrogen gas and a hydride gas to form voids in the second GaN layer and the Ti layer;

epitaxially growing a GaN substrate on the Ti layer in which voids are formed; and

exfoliating the GaN substrate from the Ti layer.